



Yesterday's Tomorrows: Past Visions of Future Financial Markets

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Introduction

It is easy to imagine that the present - yesterday's tomorrow - was always the future expected in the past. Yet, what we now accept as the normal state of affairs - the present - was not the only possible outcome that could have come to pass nor was it often the most commonly expected one. What is now considered "inevitable" - when viewed from the vantage point of 20/20 hindsight - was often not immediately embraced or accepted.

In order to understand where we are going it is important to understand where we have been and how we got there. I want to discuss some past visions of the future of financial markets, in general, and derivative markets, in particular, as seen by academics, practitioners and policymakers at various points in time. There are few advantages of age but one of them is the opportunity to witness changes and remember the contemporary context in which they occurred. I have been fortunate to have had a catbird seat

to observe some of the changes in financial markets; first as a student of finance, and later with service: at a regulator; at an exchange; as a trader; in academia. I will draw upon some of my recollections and personal experiences in the discussion that follows.

Most readers have always lived in a world where exchange traded derivatives on financial assets existed. Many readers have always lived in a world where interest rate swaps and other over-the-counter (OTC) derivatives were important. Many readers have always lived in a world where exchange traded derivatives on energy, in general, and crude oil, in particular, existed and were important. Some readers have always lived in a world where large Asian financial and commodity futures markets existed and were important in the global price discovery process. Yet, this was not always the case.

Yesterday's Tomorrow: 1972

2012 marked the 40th anniversary of the development of the first successful financial futures contracts. On May 16, 1972—trading on foreign exchange or FX futures began on the International Monetary Market (IMM) in Chicago. The IMM was established as an independent exchange and later became a division of the Chicago Mercantile Exchange (CME). FX futures arose in part because small speculators had a difficult time trying to put short speculative FX positions on with the large banks that dominated the market.¹

To be sure, FX futures had been introduced earlier but failed. The first FX futures contracts were introduced on April 23, 1970 on the International Commercial Exchange (not to be confused with the present Intercontinental Exchange or

ICE) in New York. Leo Melamed argued that the reason why the IMM-traded FX futures were successful was timing - the Bretton Woods Agreement and its system of fixed exchange rates had collapsed.²

Yesterday's Tomorrow: 1973

It has been 41 years since the introduction of exchange traded equity options. On April 26, 1973, options trading in 16 listed stocks began on the Chicago Board Options Exchange (CBOE). According to the CBOE, 911 option contracts traded on opening day. Only call options were allowed to trade. Today, exchange traded equity options are an integral part of financial markets.

What did the *future* look like in the *past*? Specifically, what did it look like for exchange traded equity options? There were a number of worries. One worry was that speculators would eschew trading in the cash stock market in favor of trading equity options. That is, a successful options market would cause trading volume on the stock market to dwindle as people traded options instead of stocks. The fundamental premise behind this fear - that option prices would be volatile while equity prices were stagnant reveals a fundamental misunderstanding of the nature of options. Another fear at the time was that if trading in put options were permitted it would push down stock prices. This fear was powerful enough to cause the Securities and Exchange Commission (SEC) to prohibit trading in put options for almost an additional 4 years. Thanks to this decision, put-call parity in U.S. exchange traded equity options remained a theoretical concept during those four years.

It is easy to imagine that exchange traded options began with the trading of equity options on the CBOE. However, it is important to note that exchange traded options did not begin with exchange traded equity options. Indeed, options on futures ("privileges") were once common on U.S. commodity futures markets as Miller (1986) notes. However trading in "privileges" (futures options) was prohibited and then re-allowed in the U.S. in the 1980s. It is also important to recall that the Chicago Board of Trade (CBOT) created the CBOE.³ Put differently, the idea of exchange traded equity options originated at a futures exchange in Chicago. Given that the first successful financial futures contracts also originated in Chicago, there is also an important lesson about the nature of financial innovations—namely, they don't always originate in financial capitals.

2013 also marked the 40th anniversary of the publication of the seminal article on option pricing by Fisher Black and Myron Scholes. This article is often rightly credited with both stimulating academic research and igniting the subsequent explosion in derivatives trading.

The Black-Scholes article is also every Editor's nightmare. It was rejected by many journals before it was finally accepted at the *Journal of Political Economy*. The seminal article by Fisher Black and Myron Scholes played a crucial role in stimulating the use, and study, of options. In a testament to the power of the wisdom of (trading) crowds, later studies showed that competitive markets reached similar prices even before the Black Scholes model was developed. For example, Moore and Juh (2006) report evidence that Johannesburg Stock Exchange traded "warrant prices were surprisingly accurate" during 1909-1922.

Interestingly, in the mid 1980's Merton Miller (1986) argued that the development of financial futures rather than exchange traded equity options was the most important financial innovation of the previous 20 years. The essence of Merton Miller's argument is that the development of financial futures preceded the development of exchange traded equity options and that the success of FX futures contracts stimulated the development of futures contracts on numerous other financial instruments.

It is tempting to believe that all currently successful financial futures were an immediate success. However, they were not always immediately embraced. For instance, the Chicago Board of Trade introduced Treasury bond futures on August 22, 1977. The 30-year U.S. Treasury bond futures market traded around 4,000 contracts a day until early October 1979 when the Federal Reserve switched to targeting the quantity of money rather than interest rates. The ensuing volatility in interest rates that resulted from this central bank policy shift created a need for investors to manage interest rate risk exposure or face the risk of large avoidable losses. Essentially, volatile financial markets penalized those who failed to avoid risk by not hedging. In this sense, government and central bank policy played an important role in making financial futures successful by exacerbating financial market volatility.

Yesterday's Tomorrow: 1981

It has been 33 years since the first interest rate swap was transacted in 1981 between the World Bank and IBM. This financial market took off quickly. In contrast, Eurodollar futures took longer to become successful even though they allow one to replicate interest rate swap positions. However, the need by swap dealers to hedge their net interest rate swap exposure helped make the Eurodollar futures market incredibly successful. It also stimulated active trading in deferred contract months—so much so that Eurodollar futures trading extended 10 years out into the future.

Yesterday's Tomorrow: 1980s

The New York Stock Exchange (NYSE) created the New York Futures Exchange (NYFE or "Knife") in 1980 in an attempt to bring the financial futures business to New York. The introduction of stock index futures in 1982 pitted the Chicago Mercantile Exchange, which traded futures contracts based on the S&P 500 stock index against the NYFE, which traded futures contracts based on a New York Stock Exchange index. Both started to trade at the same time in April 1982. It was not immediately clear which exchange would dominate stock index futures trading.

To be sure, the NYFE failed to attract much trading volume to its Treasury bond futures contract where it competed against the Chicago Board of Trade but that was an established market.⁴ Both markets traded futures in pits using open outcry. Ultimately, Chicago won the battle and dominated financial futures trading in the U.S. Incidentally, Chicago would likely also have dominated U.S. equity options trading were it not for a SEC desire to regulate multiple option exchanges. The SEC ensured the existence of multiple options exchanges by dividing potential stocks for listed options among multiple exchanges rather than letting the Chicago Board Options Exchange dominate the nascent market.

Both the Chicago Mercantile Exchange and the Chicago Board of Trade recognized the potential demand for financial futures outside the U.S.A. However, they took two different approaches to it. The Chicago Board of Trade attempted to keep much of the business in Chicago by introducing evening pit trading to accommodate foreign order flow outside of normal Chicago business hours. The Chicago Mercantile Exchange established alliances with a number of non-U.S. futures markets including the Singapore International Monetary Market (SIMEX) where it entered into a mutual offset agreement for Eurodollar futures contracts traded on the two exchanges. Mutual offset allowed traders to open a position in Eurodollar futures on one market and close it in the other market.

Yesterday's Tomorrow: 1982

The London International Financial Futures Exchange (LIFFE) was formed in 1982. It was established as an open outcry market. By 1996, after mergers with the London Traded Options Market and the London Commodity Exchange, LIFFE was the dominant futures market in Europe with its most important contract being German bund futures.

Yesterday's Tomorrow: 1983

Looking back, 2013 also marked the 30th anniversary of the introduction of crude oil futures by the New York Mercantile Exchange (NYMEX). Heating oil futures and gasoline futures had already been introduced by the NYMEX and were trading actively. However, many observers were skeptical whether the NYMEX could achieve similar success for crude oil futures given that several major oil companies (known as the "Seven Sisters") dominated the spot oil market at the time. Indeed, some industry participants argued that they didn't need crude oil futures to hedge and that they wouldn't use the new futures contracts. They were wrong.

At the time, futures exchanges viewed energy as the last great-untapped commodity market. Both the Chicago Board of Trade and the Chicago Mercantile Exchange sought to wrest control of the energy futures markets from the NYMEX. They failed. Just as the NYSE's NYFE fought a losing battle to wrest control of financial futures from the Chicago markets, the Chicago futures exchanges fought a losing battle to wrest control of the energy futures markets from New York. Why did the NYMEX—an exchange whose most important futures contract less than a decade earlier was Maine potatoes—succeed and the far larger CBOT and CME fail? Was it a lack of resources? No, both Chicago futures exchanges invested huge amount of money into making their energy futures markets successful. Their failure reflects the difficulty in attracting customer order flow from an existing liquid futures market. While it can be done as Holder, Tomas and Webb (1999) show, it is difficult to do.

I had a catbird's seat from which to view the introduction of new futures contracts. I was trading as a local (i.e., independent trader) on the floor of the Chicago Mercantile Exchange at the time. The contract that I was principally trading was the S&P 500 stock index futures which opened later than the two energy contracts that the CME decided to introduce in 1984—unleaded gasoline and no. 2 heating oil. (The CME had obtained approval to trade crude oil futures but it held that contract in reserve to be introduced after CME gasoline and heating oil futures became successful.) To showcase the new energy futures markets, the CME decided to televise the opening live to a meeting of the American Petroleum Institute. Prior to the launch, the CME had a campaign to persuade locals to dedicate 15 minutes a day to make the contracts successful by providing the liquidity needed to attract public order flow. Because the S&P 500 stock index futures opened later than the new energy futures markets, I decided to help make a market in unleaded gas and heating oil at the opening on the first day of trading.

Unlike most futures markets where there is a burst of frenetic activity at the open and a cacophony of sound, there was dead silence when the new energy futures contracts opened for trading on the CME. All of us in the pit were staring at the board on the wall, which displayed real-time prices from other futures markets waiting to see where NYMEX opened so that we could price the new futures contracts correctly. The market soon had a 21 tick spread for a one lot (or \$84). Needless to say, the NYMEX kept the gasoline and heating oil futures markets as trading volume soon withered on the CME.⁵

Yesterday's Tomorrow: 1988

2012 marked the 25th anniversary of the U.S. stock market crash of October 19, 1987. 2013 marked the 25th anniversary of the official Brady Commission report, which examined the nature and causes of the stock market crash. At the time, some observers blamed index arbitrage and portfolio insurance for the Crash. However, as the Brady Commission report showed index arbitrage was not the culprit.⁶ There was also significantly less portfolio insurance induced trades than there might have been as many of the human portfolio managers did not send the portfolio insurance program generated sell orders to the market. Despite the passage of considerable time, the causes of Crash remain unknown.⁷

One consequence of the '87 Crash is that it impacted how options are priced. After the Crash deep out-of-the-money option prices reflected the leptokurtic nature of financial markets and the possibility of another crash. From an academic perspective, the '87 Crash stimulated research applying extreme value theory to financial markets. The '87 Crash also stimulated research on behavioral finance as the assumption of market efficiency was called into question.

Yesterday's Tomorrow: 1990

In 1988, the all electronically traded Deutsche Termin Boerse was founded by a number of German banks. It started to trade options and then futures in 1990. It offered a variety of financial futures contracts - on the German bund and other German securities and German stock indices. It was in head-to-head competition with the LIFFE over the German bund futures market and other futures contracts. It slowly acquired about one-third of the total market with LIFFE having the balance.

Yesterday's Tomorrow: 1997

Electronic trading dominates today's markets. Yet, the seemingly inevitable "electronic" future of futures trading took longer to dominate U.S. futures markets than expected. The International Exchange or Intex - an all-electronic exchange - was proposed in 1980. I attended a presentation that the founders made to staff at the U.S. Commodity Futures Trading Commission in 1981. Although the founders initially intended it to be a U.S. regulated futures market, the exchange opened in Bermuda in 1984 offering a raft of popular futures contracts that were traded on competing U.S. futures markets. It failed.

When the electronic trading platform, Globex, was first introduced by the CME the French futures market, the Matif, accounted for most of the trading volume due to its heavy volume of after hours or "curb" trading. Perhaps surprisingly, options - the most complicated product to trade - remain the last area where pit trading is important in the U.S.

For many years the all electronically traded Deutsche Terminboerse (DTB) had captured about a third of the market of bund futures market. In the autumn of 1997, it captured about half of the trading volume with LIFFE capturing the balance. And LIFFE's share continued to fall. Electronic trading beat pit trading. This was the death knell for LIFFE bund futures. The dramatic collapse of pit trading on the Matif and the rapid loss of market share in bund futures by LIFFE to the DTB sent a shockwave of fear to traders in open outcry markets around the world. It was clear that the end of open outcry trading was near.

The Sydney Futures Exchange (now part of the ASX) started to phase out open outcry in 1997 and went fully electronic on November 15, 1999. Why did the change occur in 1997 rather than 1990 when DTB was introduced? The key to understanding the rapid collapse of trading volume on the LIFFE is to recognize the importance of public order flow. Ignoring transaction costs, futures trading is a zero sum game. If there is no public order flow in an open outcry futures market the participants are simply picking each other's pockets as every dollar won comes at the expense of someone else in the pit. If there is public order flow, then the pit community can profit from making a market for outside orders. Some observers estimate that between 30 to 40% of all pit trading volume represents trading by locals trying to make a market. The sudden collapse of public order flow took with it much of that market.

The key point is that electronically traded markets were not instantly successful in displacing open outcry markets. The dominance of the DTB in bund futures came after the German bank owners of the DTB were persuaded to send their orders to the DTB rather than the LIFFE.

Yesterday's Tomorrow: 1998 - The Virtual Collapse of LTCM

The virtual collapse of LTCM in September 1998 was not a derivatives event per se but it did stimulate research on liquidity risk across the spectrum of financial markets. Interestingly, earlier examples of the failure of similar types of funds - such as the 1994 collapse of Askin Capital and the loss of \$640 million - failed to impact academic research on liquidity risk. This contains an important lesson for academic researchers; namely, watch the financial markets.

Yesterday's Tomorrow: 2003

It has been 16 years since the all-electronically traded Deutsche Terminboerse merged with the Swiss Options and Financial Futures Exchange to form Eurex. Electronic trading was the future. The U.S. futures markets still had a significant amount of trading occurring in the pits. Eurex was the future. The CBOT and CME were the past. How long would pit trading in Chicago last?

It was 11 years ago that Eurex filed an application with the U.S. Commodity Futures Trading Commission to create a U.S. based electronic exchange. The objective was to compete directly with the largely pit traded Treasury futures contracts traded on the Chicago Board of Trade (CBOT). Everyone knew that open outcry trading in Chicago was doomed and Eurex USA would displace the Chicago Board of Trade (and later the CME).

Yesterday's Tomorrow: 2004

It was 10 years ago that Eurex USA started to trade in February 2004. Yet, a funny thing happened en route to Eurex USA's expected total domination of the U.S. Treasury futures markets. 2004 was not 1997. The CBOT fought back with lower fees (which illustrates the importance of transaction costs) and an electronic trading system of its own (where a large fraction of trades occurred). This last point was missed by many in the financial press who portrayed the battle as simply pit vs. machine. Not surprisingly, Eurex USA was defeated.

Yesterday's Tomorrow: 2004

It has been almost 6 years since the bankruptcy of Lehman Brothers during the depths of the Global Financial Crisis (GFC). Derivative exchanges worked well during the GFC. None failed. However, uncertainty about the true size of credit default swap (CDS) positions of participants in the OTC derivatives market led to calls to change OTC derivatives trading. Credit default swaps (which by some accounts originated at JPMorgan in 1997) had grown to \$62 trillion in notional value by 2008. Concern over the potential for OTC traded credit default swaps to create systemic risk prompted calls for change.

In September 2009 leaders of the G-20 nations agreed that: "All standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end 2012 at the latest. OTC derivatives should be reported to trade repositories. Non-centrally cleared contracts should be subject to higher capital requirements."⁸

The G-20 decision to impose stricter rules on OTC derivatives trading bodes well for derivatives exchanges even if it is not yet fully implemented. However, one must distinguish between the future of derivative markets and the future of derivative exchanges. Some potential challenges remain. Some observers argue that the large market capitalization of futures exchanges stems from a competitive advantage they enjoy from the lack of fungible futures contracts. Witness the sharp negative reaction of the CME stock price on February 5 and 6, 2008 to the announcement that the Antitrust Division of the U.S. Department of Justice suggested a separation of the clearinghouse from futures exchanges.⁹

The Future of Derivative Markets

Electronic trading lessens the need for numerous physical derivatives exchanges. A number of exchanges have merged in recent years. Consolidation of exchanges should continue to occur. However, there are limits to this trend. Transnational mergers of derivative exchanges are difficult in some jurisdictions - as the failed 2012 bid for the Australian Securities Exchange (ASX) by the Singapore Exchange (SGX) shows.

Electronic trading has also increased the demand for physical proximity to exchange servers to reduce (exchange) latency. Frino, Mollica and Webb (2014) study the impact of the introduction of co-location on the ASX futures markets and report evidence showing that co-location has increased futures market liquidity despite providing high frequency traders with only a small temporal advantage over those not co-located but with "real-time" access to exchange data.¹⁰

The Rise of Algorithmic and High Frequency Trading (HFT)

Electronic trading is a necessary but not sufficient condition for high frequency trading. The rapid growth of algorithmic and high frequency trading has captured the attention of market participants, policymakers, and academics alike especially after the May 6, 2010 Flash Crash in U.S. equity markets. A joint SEC-CFTC report on the causes of the Flash Crash revealed that high frequency trading was not to blame for precipitating the Flash Crash but it also did little to stop it either.¹¹ Rather, a 5 second trading halt on the CME stopped the downward spiral of futures prices and with it the Flash Crash.

Baron, Brogaard and Kirilenko (2014) examine the profitability of HFT firms in the CME e-mini S&P 500 stock index futures market over a two year period. They report evidence suggesting that HFT firms have exceptionally high Sharpe ratios. Put differently, HFT firms have exceptionally high returns with little if any risk. Interestingly, the most aggressive (i.e., liquidity taking) HFTs make substantially more profits than the passive (i.e., liquidity providing) HFTs. Moreover, the profits HFT firms make seem to persist over time. They also report evidence that only a few HFT firms make most of the profits.¹² Although considerable attention is focused on the high speed of decision making by high frequency traders, Easley, Lopez de Prado and O'Hara (2012) point out that algorithmic trading is not dependent upon speed.¹³

Perceived problems with algorithmic and high frequency trading have led to a number of proposals on how to deal with the problems (if indeed they exist). It has also stimulated academic research in this area. Suggested solutions include taxes on messages, fees for cancelled orders, minimum resting order times to replacing continuous markets with high frequency periodic call markets. However, academic research is often an uneven predictor of how markets will evolve. The academic view of what is good for markets is not always what the market adopts and market participants appear to want.

Conclusions

Derivatives exist because they are needed. They facilitate price discovery and risk transference. As long as markets are volatile the outlook for derivatives markets will remain strong. The evolution of financial markets will certainly continue as the needs of market participants and technology changes. However, as we have seen with many past visions of the future, *Yesterday's Tomorrows*, our current perception of what financial markets will look like tomorrow, *Today's Tomorrow*, may be a poor predictor of what tomorrow's financial markets will actually look like and when seemingly inevitable changes will occur.

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Notes:

1. Merton Miller (1986) contends that the intellectual stimulus for establishing FX futures trading may have arisen from a conversation Milton Friedman had with Leo Melamed, (a senior Chicago Mercantile Exchange official and widely regarded as the "father" of financial futures) where Professor Friedman mentioned his difficulty in establishing a short position in the pound sterling with banks.
2. Melamed, L., <http://www.leomelamed.com/essays/87-acfx.htm>
3. Miller (1986) notes that exchange traded equity options were proposed by the Chicago Board of Trade in 1969 but not immediately implemented due to regulatory issues.
4. The U.S. Commodity Futures Trading Commission (CFTC) approved trading in Value Line stock index futures contracts on the Kansas City Board of Trade (KCBOT) in February 1982 and allowed stock index futures trading to begin on the CME and NYFE in April 1982. The KCBOT was the first futures exchange to propose trading in stock index futures.
5. The CBOT's attempt to take the energy futures business away from the NYMEX also failed.
6. Report of the Presidential Task Force on Market Mechanisms, January 1988, <https://archive.org/details/reportofpresiden01unit>
7. The notion that index arbitrage could cause a stock market crash reveals a fundamental misunderstanding of the nature of arbitrage. Arbitrage is price stabilizing rather than price destabilizing. Moreover, there is often less arbitrage trading than many individuals believe. Miller, Muthuswamy and Whaley (1994) point out: "But, if the predictability of basis changes is mainly a statistical illusion, as we have argued, why do we see so much index arbitrage on the NYSE? ... The answer, we have shown, is that we don't really see all that much of it. Formal index arbitrage during our sample period accounts for only about four percent of NYSE volume."
8. Leaders' Statement, G-20 Meeting, Pittsburgh Summit, September 24-25, 2009. http://ec.europa.eu/commission_2010-2014/president/pdf/statement_20090826_en_2.pdf
9. Webb and Webb (2013) discuss this issue.

10. Frino, Mollica and Webb (2014) report that ASX officials estimated that market participants that were co-located had about a 2-millisecond advantage over non-co-located participants in the ASX futures markets with "real-time" access to exchange data.
11. U.S. CFTC-SEC Joint Task Force, "Findings Regarding the Market Events of May 6, 2010," September 30, 2010, <http://www.sec.gov/news/studies/2010/marketevents-report.pdf>
12. Baron, Brogaard and Kirilenko (2014) use gross trading profits as a proxy for net trading profits. This likely significantly overstates the profitability of high frequency trading. However, given the high Sharpe ratios that Baron et al. (2014) report, even substantial adjustments for net trading profits would likely leave the conclusion unchanged that HFT firms make outsized returns while bearing little, if any, risk.
13. Easley, Lopez de Prado and O'Hara (2012) regard high frequency trading as a form of *strategic sequential trading* and trading as a game. They compare floor and off-floor trading venues. "A chess player makes moves at different speeds during a game, depending on several factors: Superiority over the adversary, stage of the game, ... time remaining before the end of the game, etc. It would make little sense for a chess player to attempt making moves every minute ... but rather moves take place whenever the processing of the new information permits Players try to anticipate each other's moves several steps ahead, and force the adversary to make an error."

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